WHAT IS CLAIMED:

1. An ultrasonic apparatus for producing three dimensional images using at least one moving curved array transducer for scanning a volume of a region of interest to be imaged, said apparatus comprising:

an acoustic front shell having complex shape;

an ultrasonic transducer adapted for swinging movement underneath said front shell and having a front surface of a shape conforming to the complex shape of said front shell; and

drive means for providing said swinging movement of the ultrasonic array transducer underneath said front shell so as to scan a volume of the region of interest.

2. An ultrasonic apparatus according to claim 1 wherein the apparatus comprises a mechanical probe, wherein said transducer has a rotation axle, and wherein said drive means comprises a motor mounted in direct driving relation with the transducer through the rotation axle of the transducer.

3. An ultrasonic apparatus according to claim 1 wherein the apparatus comprises a mechanical probe, wherein the array transducer is of a curved linear shape wherein the front shell has an internal surface, and wherein all of the front surface of the transducer conforms to the complex shape of the internal surface of the front shell.

4. An ultrasonic curved array transducer for use in a three dimensional mechanical imaging probe, including a front shell, having an internal surface, disposed in front of the transducer, said transducer comprising:

an external focusing lens made of silicon rubber and including a front face having variable radius of curvature exactly corresponding to that of the front shell in front of said transducer, said variable radius of curvature varying in a manner such as to minimize the distance separating the front face of the focusing lens and the internal surface of the shell, and

a piezoelectric member for emitting and receiving ultrasonic energy, said piezoelectric member being assembled beneath said focusing lens and having a variable surface curvature compensating for the variable radius of curvature of the focusing lens in a manner such as to enable the transducer to maintain a common elevational focus for all transducer elements of the array transducer, said transducer having an external elevation surface profile parallel to the corresponding internal profile of the front shell of the probe.

5. An ultrasonic array transducer according to claim 4 wherein the piezoelectric member has a radius of curvature which varies from a concave shape at a center region of the array transducer to a flat shape at outer regions of the array transducer.

6. An ultrasonic array transducer according to claim 4 wherein the piezoelectric member has a radius of curvature which varies from a concave shape at a center region of the array transducer to a convex shape at outer regions of the array transducer.

7. An ultrasonic array transducer according to claim 4 wherein the piezoelectric member has a radius of curvature which varies from a flat shape at a center region of the array transducer to a convex shape at outer regions of the array transducer.

8. An ultrasonic array transducer according to claim 4 wherein the piezoelectric member has a radius of curvature which varies from a concave shape at a center region of the array transducer to a flat shape at an intermediate region of the array transducer and to a convex shape at outer regions of the array transducer.

9. An ultrasonic array transducer according to claim 4 wherein the piezoelectric member is made from a composite ceramic/polymer structure.

10. An ultrasonic mechanical probe comprising a moving array transducer, said moving array transducer comprising lips disposed at superior edges of the moving array transducer for retaining a quantity of a coupling grease.

11. An ultrasonic mechanical probe according to claim 9 wherein said lips are made of silicon rubber.

12. An ultrasonic mechanical probe according to claim 9 wherein said lips are made of elastomeric rubber.

13. An ultrasonic apparatus for producing three dimensional images using a swinging or tilting ultrasonic array transducer, said apparatus further comprising:

a probe housing having an ovoid portion in which the array transducer is mounted and having an internal surface and a central axis;

an ovoid shaped carrier of a shape conforming to the internal surface of the said probe housing, said array transducer comprising at least one curved array transducer having a longitudinal axis and being mounted at an angular position within said carrier so as to directly couple acoustic energy to the probe housing and hence to an external media; and

motorization means disposed at the central axis of the ovoid carrier for tilting or swinging the transducer around said longitudinal axis.

14. An ultrasonic apparatus according to claim 13 wherein the curved array transducer of the ovoid carrier has an external surface conforming to the corresponding internal surface of the probe housing.

15. An ultrasonic apparatus according to claim 13 wherein said ovoid carrier is shaped such that any space between the external surface of said ovoid carrier and the internal surface of the probe housing is reduced to a minimum and wherein said space is filled by a thin film of coupling liquid or grease.

16. An ultrasonic apparatus according to claim 13 wherein said motorization means comprises rotational motorization means located at a center portion of the ovoid carrier so as to provide rotation of the ovoid carrier around a central axis.

17. An ultrasonic apparatus according to claim 13 wherein the said ovoid carrier includes a central hollow space in which is located interconnection means for transducer elements of said array transducer.

18. An ultrasonic apparatus according to claim 13 wherein said ovoid carrier comprises at least a first curved array transducer mounted at a first angular position and a second curved array transducer mounted at a second angular position so as to enable the probe to simultaneously scan two distinct informational volumes.

19. An ultrasonic apparatus according to claim 13 wherein said ovoid carrier comprises at least one first curved array transducer mounted at a first angular position and dedicated to imaging applications and a second curved array transducer mounted at a second angular position and dedicated to high intensity operations in therapy applications.

20. An ultrasonic apparatus according to claim 19 wherein the imaging operation for a given region of interest can be replaced by a high intensity operation using said second transducer operating in the given region.

21. An ultrasonic apparatus according to claim 13 wherein the ovoid carrier is capable of rotating through an angle of more than 360 degrees without damage to interconnection means for said array transducer.

22. An ultrasonic apparatus according to claim 13 wherein the ovoid carrier is provided with at least two oppositely curved array transducers and where the ovoid carrier is capable of rotating through an angle up to 180 degrees.